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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 09/609,387      | 07/03/2000  | T. Frank Wang        | 8229-006-27         | 3989             |

7590 10/04/2004  
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| EXAMINER |
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DEO, DUY VU NGUYEN

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| ART UNIT | PAPER NUMBER |
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1765

DATE MAILED: 10/04/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

|                              |                                      |                                       |  |
|------------------------------|--------------------------------------|---------------------------------------|--|
| <b>Office Action Summary</b> | <b>Application No.</b><br>09/609,387 | <b>Applicant(s)</b><br>WANG, T. FRANK |  |
|                              | <b>Examiner</b><br>DuyVu n Deo       | <b>Art Unit</b><br>1765               |  |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE \_\_\_\_ MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on the RCE filed 7/26/04.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-35 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-35 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |   |  |
|---|--|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. ____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                  | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)            |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date ____ | 6) <input type="checkbox"/> Other: ____  |

## **DETAILED ACTION**

### ***Claim Rejections - 35 USC § 102***

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1-3, 5-7, 10-12 are rejected under 35 U.S.C. 102(b) as being anticipated by Mu et al. (US 4,980,018).

Mu describes a method a semiconductor device comprising: providing a unetched semiconductor device having several layers, at least on of the layers is a refractory metal-containing material such as W (col. 5, line 32-45); etching the semiconductor device with a first etchant having SF<sub>6</sub>, Cl<sub>2</sub>, He (claimed a chlorine source free of BCl<sub>3</sub> and a fluorine source) (col. 3, line 53-54) and followed by a second etchant comprising Cl<sub>2</sub> and He (claimed etchant which is free of fluorine) (col. 4, line 5).

Referring to claim 12, the flow rates of Cl<sub>2</sub> is about 130 sccm and of He is 50 sccm (col. 8, line 29-32). This would make the Cl<sub>2</sub> concentration is about 72 %, which is within claimed 50-95%.

### ***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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4. Claims 13-18, 20-21, 24, 25, 29-35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mu as applied to claims 1 above, and further in view of Kugimiya et al. (US 6,277,763).

Mu describes the process power (source power) is 250W. He is silent about the bias power is from 200-500W. Kugimiya teaches etching refractory metal layer having the source and bias power of 100-1000W and 10-300W (col. 5, line 10-14). These processing parameters would overlap claimed processing parameters of source and bias power and their ratio. It would have been obvious at the time of the invention to one skill in the art in light of Kugimiya's teaching of the bias power because Kugimiya further teaches other processing parameters such as bias power that is silent by Mu to etch the refractory metal with a reasonable expectation of success.

Mu's method shows the refractory metal is deposited above the oxide layer (col. 4, line 53-56) and the step of overetching (second etchant) would expose the under oxide layer and therefore would also remove some of the under oxide layer 13 (figure 3). This would read on claimed partially etching through the oxide layer with the second etchant.

5. Claims 4, 8, 19, 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mu or Mu/Kugimiya as applied to claims 1, 5, 15, 17 above.

Even though Mu doesn't describe the refractory metal-containing comprise TiW alloy (claim 4). However, he describes that the method can be applied to etch other refractory metals, with minor adjustments in operating parameters (col. 5, line 42-45). Therefore, at the time of the invention, using the method to etch the TiW would have been obvious since W and TiW are used

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in manufacturing various semiconductor devices (please see page 1 of the specification) with a reasonable expectation of success.

Referring to claim 8, Mu doesn't describe the Cl<sub>2</sub> in the first chemistry is about 50-95%. However, he teaches that the processing parameters including flow rate may be varied and depending the material being etched (col. 5, line 41-45; col. 6, line 13-17). This would show that the parameters in the processing are result-effective variables. Therefore, at the time of the invention, it would have been obvious for one skill in the art to determine the optimum processing parameters including the flow rate or concentration of Cl<sub>2</sub> through routine experimentation in order to etch the refractory material with a reasonable expectation of success.

6. Claims 9, 23, 26-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mu or Mu/Kugimiya as applied to claims 5, 15 above, and further in view of Roberts et al. (US 5,626,775).

Referring to claims 9, 23, 26-28, using other carrier gas such as N<sub>2</sub> is well known to one skill in the art in the art of etching semiconductor device. Roberts shows the carrier gas including He and N (col. 5, line 25-26). It would be obvious at the time of the invention, using any of those carrier gas would be equivalent to etch the refractory material with a reasonable expectation of success.

Referring to the processing parameters such as the flow rates of the etching gases in the first and etchants. Mu teaches that the processing parameters including flow rate may be varied and depending the material being etched (col. 5, line 41-45; col. 6, line 13-17). This would show that the parameters in the processing are result-effective variables. Therefore, at the time of the

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invention, it would have been obvious for one skill in the art to determine the optimum processing parameters including the flow rate or concentration of Cl<sub>2</sub> through routine experimentation in order to etch the refractory material with a reasonable expectation of success.

***Response to Arguments***

7. Applicant's argument that Mu's first etching chemistry, which includes SF<sub>6</sub>, O<sub>2</sub>, and He, would not read on claimed first etchant of Chlorine source free of BCl<sub>3</sub> and a fluorine source is found unpersuasive because the first etchant described by Mu is not necessary to correspond to the claim first etchant. Any etchant that describes the claim first etch chemistry would read on it. In this case, Mu's second etchant would read on claimed first etchant.

***Claim Rejections - 35 USC § 112***

8. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

9. Claims 1-14 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Applicant has not shown where in the specification teaching of providing an unetched semiconductor device.

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10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to DuyVu n Deo whose telephone number is 571-272-1462. The examiner can normally be reached on 6:00-3:30; with alternate Friday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

DVD  
9/29/04

